ESIC2024 Posted: 16/04/2024 DOI: 10.70082/esic/8.1.9

Smart Heritage Preservation: Design and Implementation of an Internet of Things (IoT)-Enabled Image Information Management System for Yuan Dynasty Taoist Murals in Shanxi

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Abstract

This study facilitates the development of an Internet of Things-based picture information management system for the preservation of cultural assets. Through an analysis of Taoist murals from Shanxi's Yuan Dynasty, this initiative seeks to improve cultural relics' monitoring, accessibility, and preservation. Data gathering, picture preprocessing, PIM architecture, IoT system design, and secondary data analysis are all included in the methodology. Drones and digital cameras provide high-resolution Taoist painting data, which is preprocessed to enhance detail and minimize noise. The Internet of Things system includes cloud-based picture database producers, environmental sensor networks, and climate control actuators. Using secondary data from government documents, websites, museums, and research increases the depth and accuracy of the study. Hard data supports the potential benefits of an Internet of Things-enabled picture information management system for cultural artifact preservation. Real-time monitoring and proactive conservation against peeling, fading, and cracking. The study shows how centralizing photo management in the PIM design improves accessibility for scholars and the general public. Some of the implications for practice include more public participation with cultural assets, proactive conservation, and better scholarly research. Future studies may examine the development of IoT-based preservation systems and the conservation of socio-cultural heritage.

Keywords: Image information management system, Yuan Dynasty Taoist Murals, Heritage Preservation, IoT-enabled System, Taoist Murals Shanxi, Image Management.

Within the intricate web of human history and cultural inheritance, the field of heritage preservation studies is an essential undertaking for preserving and honoring our historical riches. This research sets out on an exploratory voyage into the heart of Shanxi, China, against the backdrop of this strong devotion to conserving the echoes of bygone times. There, the exquisite Yuan Dynasty Taoist paintings tell narratives of spirituality, artistic talent, and historical relevance. The researches develop and deploy an Internet of Things (IoT)-based image information management system. The ultimate goal is to guarantee that technology will be held

responsible for safeguarding cultural heritage in the future. It is an artistic attempt to use cutting-edge technology in conjunction with traditional creative techniques to conserve and improve the accessibility and comprehension of great works of art (Cao, 2023; Qu, 2018). Nestled in the province of Shanxi, the Taoist paintings from the Yuan Dynasty are silent witnesses to the passage of centuries, with each brushstroke conjuring recollections of a bygone era. In this environment, heritage preservation becomes a dynamic interaction between history and the modern digital era, going beyond simple conservation. The study's appeal is found not only in the observable results of an advanced Internet of Things system, but also in the more profound resonance of erasing time differences and uniting generations via a common appreciation of cultural legacy. Shanxi's rich historical fabric makes the past and present dance captivatingly together on a live canvas(Burrows, 2022; Holdstock, 2017).

A tale of technical innovation supporting cultural preservation emerges when the brushstrokes of historic paintings collide with complex IoT algorithms. This research tells a story about creating a strong bond between the past and the present, a synergy where the digital buzz of modern technology is accompanied by the faint sounds of old creativity. It is not only about protecting paintings. It explores how, in the process of preserving, we open up fresh perspectives and levels of appreciation, guaranteeing that the cultural heritage of the Taoist paintings from the Yuan Dynasty will always be discussed.(Saussy, 2019).

Despite the bright future of combining IoT technology with cultural conservation, a clear research vacuum appears when considering the unique difficulties presented by Shanxi's Yuan Dynasty Taoist paintings. Although the body of research(Cang, 2023; Chen & Ran, 2020; Fang, 2016; Wu & Shao, 2022) on IoT-based heritage conservation offers useful insights, there is a noteworthy lack of studies that specifically address the challenges of maintaining historic paintings in an area with different climatic conditions. The current corpus of literature mainly ignores the complex relationships that exist between Shanxi's climate, including elements like dryness, and how they affect mural materials over time. By examining the unique difficulties presented by the murals in Shanxi, this study seeks to close this gap and provide a customized and creative method for IoT-enabled preservation(Hinrichs, 2018). The environmental impact of Shanxi Yuan Dynasty Taoist artworks alarms (Naquin, 2022; Wong, 2021, 2021) Shanxi-specific mechanism absence raises risk. Conservation approaches without adaptive temperature management and real-time monitoring risk mural damage. Without a centralized picture information management system that overlooks murals' historical and visual features, this study is harder. Given these issues, specific action is needed to protect this cultural legacy. (Mann, 2008) discusses fixing mural faults with IoT. Actuators regulate climate, sensors monitor in real time, and cloud-based IoT systems process images in custom systems. Restoring Shanxi's Yuan Dynasty Taoist murals will ensure their survival. Technical gaps in cultural heritage conservation must be researched quickly. IoT-enabled technologies could protect paintings from environmental hazards and preserve their beauty. Future generations must value this priceless cultural resource.

IoT-based photo information management will preserve Shanxi Yuan Dynasty Taoist murals. Real-time environmental monitoring with advanced IoT. This approach is complemented with a central photo database with vital data. Creative culture includes mural preservation with cutting-edge technology. This effort uses cutting-edge technology to preserve historical things, creating a new cultural heritage preservation paradigm. The study reveals how culture and technology interact beyond technological advances. The project conserves Yuan Dynasty Taoist murals swiftly using an IoT device and sets a precedent for technology-

cultural heritage study. The project establishes proactive monitoring, data management, and public participation to conserve Yuan Dynasty Taoist murals. This comprehensive approach preserves murals and community-cultural item links. Project educates and promotes cultural heritage conservation through public engagement. This revolutionary research endeavor proposes a comprehensive technological and cultural resource protection plan.

This study pioneers Shanxi Yuan Dynasty Taoist mural IoT preservation. An advanced picture information management system is carefully created and implemented to meet local environmental challenges. An unparalleled mix of technology and cultural asset preservation improved accessibility, conservation, and monitoring.

To holistically maintain Shanxi Yuan Dynasty Taoist murals, the initiative uses IoT-based photo information management. Our unified photo database with vital data and IoT-enabled environmental monitoring aim to preserve these historic treasures. Innovative technology prioritizes culture and technology over technology to preserve cultural heritage. To preserve Yuan Dynasty Taoist murals, literature proposes proactive monitoring, data management, and public participation. The study reveals how Shanxi Yuan Dynasty Taoist artworks affect the environment, showing the complicated relationship between culture and sustainability. The Shanxi climate is considered when designing every IoT-enabled system component to address environmental challenges. This study explains how real-time environmental sensors and cloudless photo databases preserve cultural commodities. Technology-based cultural heritage preservation increases Yuan Dynasty Taoist mural access, protection, and monitoring. Through public involvement and cultural heritage conservation education, this initiative promotes community-cultural item links and a comprehensive technical and cultural resource protection plan.

Literature Review

This study reviewed mural repair, IoT in cultural heritage, and heritage protection studies. Previous research has emphasized how crucial it is to preserve cultural heritage worldwide in order to uphold a society's identity and historical continuity. The use of IoT technology to heritage conservation has been studied by several academics, who have emphasized the potential for data-driven decision-making and real-time monitoring in the preservation of cultural items. Previous studies have demonstrated how different image preprocessing methods may improve the quality and interpretability of digital representations of cultural artifacts, which offers important context for the work that is being conducted here(As et al., 2012). In order to understand the difficulties old paintings, especially the Taoist murals in Shanxi from the Yuan Dynasty, encounter, historical contexts have been studied. Traditional approaches have been the main emphasis of previous mural conservation initiatives, which has revealed limits in terms of keeping up with the rapidly changing technical world. Scholars before me have emphasized the need for a more sophisticated strategy that is adapted to the particular environmental circumstances of different areas. In addition, scholarly works have highlighted the importance of integrating information and the necessity of providing thorough documentation to support digital representations in order to enhance the cultural and historical context of conserved objects(Henderson, 2007; Lin, 2006; Wang et al., 2022). By combining knowledge from many sources, the study expands on earlier research and closes a significant gap in the literature about the unique preservation requirements of Yuan Dynasty Taoist paintings in the Shanxi area. This research offers a targeted and creative contribution to the preservation of this distinctive cultural legacy while situating itself within a larger scholarly debate on the interface of technology and heritage preservation through

an examination of previous efforts(Li, 2023; Stone, 2001).

The literature has been examining "heritage preservation" for centuries, progressing from antiquated techniques to contemporary technology implementations. Throughout the 13th century, cultures relied on oral traditions, texts, and tangible objects to pass along historical information from one generation to the next, making cultural heritage preservation mostly an informal activity. A more deliberate strategy developed as society advanced into the Renaissance and beyond, with figures like Petrarch promoting the preservation of ancient writings (He et al., 2023). The Industrial Revolution significantly changed how society felt about heritage as the 19th century progressed. A turning point was the establishment of museums and organized conservation initiatives, which demonstrated a growing understanding of the need of preserving cultural objects. Early conservation standards have been influenced through famous figures together with Sir John Lubbock and John Ruskin. With the appearance of new technology within the 20th century, there has been a paradigm alternate inside the field of cultural maintenance. Following the establishment of international organizations including UNESCO in the mid-20th century, which raised attention of the want of cultural background upkeep on a worldwide scale, standards and approaches for conservation efforts had been evolved(Clark, 2010; Giuffrida, 2008; Yiqing, 2021).

Figure 1. Here are some images of Morgan Museum by John Ruskin

Shanxi's Yuan Dynasty Taoist artwork difficulties stem from historic preservation. Historical, cultural, and religious murals face environmental, physical, and preservation concerns. These murals show Shanxi's rich cultural legacy, yet current literature ignores its uniqueness and conservation difficulties. To address these issues, the research would examine the murals' condition, preservation needs, and inventive conservation methods. Figure 1 links literature review and research suggestions. Discussed include Shanxi's murals' history, key issues, and need for current maintenance, including IoT(Mann, 2008). By solving knowledge and practice gaps, this research improves cultural preservation, especially Shanxi murals. The research uses IoT to preserve important cultural items. Real-time monitoring, data management, and public participation in suggested research safeguard Shanxi's murals and cultural assets. Scientists are investigating old and modern methods to preserve culture. IoT systems monitor and conserve in real time, drones and digital cameras capture high-resolution data, and picture preparation adds detail and prevents deterioration. The literature review suggests conserving Shanxi's murals and using IoT(Cang, 2023). This review emphasizes cultural preservation to preserve and enjoy Shanxi's rich cultural history by identifying research gaps and proposing innovative solutions(Henderson, 2007).

There has by no means been a more potent connection among the internet of things (IoT) and ancient preservation inside the twenty-first century. Conservation tactics have modified dramatically for the reason that creation of virtual recording technology inclusive of excessive-decision photography and 3-d scanning. Researchers are currently investigating novel strategies that combine traditional conservation strategies with cutting-edge generation to guarantee the ongoing renovation of cultural material. The literature presents the development of legacy preservation from antiquated methods to the cutting edge of technical innovation in the modern period, exhibiting a dynamic continuity(Cang, 2023; Liu, 2004).

In the large body of literature on heritage preservation, there is a study vacuum about the specific requirements of Shanxi's Yuan Dynasty Taoist paintings. Crafts to technology are explored in cultural preservation literature. Few Shanxi mural preservation studies exist. Most conservation literature ignores Shanxi's climate and Yuan Dynasty Taoist art's cultural relevance (McLean et al., 2008; Wong, 2021). Few studies have used IoT or other technology to preserve paintings. IoT technologies for cultural conservation have expanded fast in the 21st century, but their use in Shanxi to conserve murals is unknown. This gap highlights the necessity for a focused response that preserves artworks using modern technologies while maintaining their cultural and historical significance. The research project will develop and implement an IoT-enabled picture information management system to address Shanxi's Yuan Dynasty Taoist artworks' issues. The project enhances conservation and cultural context. This integrated strategy goes beyond conservation rhetoric to examine technology and cultural heritage protection. Finally, the literary gap highlights the necessity to blend current technology with cultural and historical knowledge. The proposed IoT research addresses Shanxi's Taoist mural preservation issues (McLean et al., 2008; Wong, 2021).

Research Methodology

Designing IoT systems are as follows. Climate management actuators for adaptive temperature control safeguard murals in ideal circumstances. A cloud-based photo database efficiently stores and retrieves mural data. A real-time environmental sensor network detects mural-affecting changes. Third, create picture information management. IoT and processed photographs create a mural data management system. Automated classification and metadata

generation using machine learning improves massive dataset system efficiency.

The fourth phase is secondary data analysis after system development. Along with image gathering, preparation, and system installation, government publications, websites, museum archives, and research give secondary data. This page describes Shanxi's Taoist art's cultural and historical relevance. Picture information management system IoT certification completes. The system's ability to improve Yuan Dynasty Taoist mural accessibility, monitoring, and preservation will be evaluated. Locals and conservationists made the plan work. Systematic investigation involves data collection, preprocessing, IoT system design, PIM system building, secondary data analysis, and assessment. This holistic study examines Shanxi's Yuan Dynasty Taoist paintings' cultural preservation and technological innovation.

The second step in IoT system design and deployment is strategically putting a sensor network around Shanxi's Yuan Dynasty Taoist murals to monitor ambient conditions. Real-time environmental data collecting requires this network. Smoothly integrated actuators control environment. Central servers track and show sensor data. Analytical methods suggest mural preservation risks. Staging three creates Image Information Management System. Segmented and preprocessed mural image collection needed. Image metadata contextualizes storage. Photographer, date, and location metadata improve image interpretation. Metadata helps users search photographs by numerous parameters for collaborative commentary and insights.

After integration and deployment, IoT and Image Information System provide real-time monitoring. Effectiveness increases with thorough monitoring and conservation. A simple online application permits system operation from any internet-connected device, enabling broad accessibility. This simple UI encourages teamwork. Systems are carefully evaluated for reliability, dependability, and user satisfaction. For preservation, the technology is implemented many times following confirmation. Shanxi's Yuan Dynasty Taoist murals are preserved by fixing problems and following procedures.

GCP or AWS cloud hosting is recommended. Sensor network-actuator communication should employ ZigBee or LoRaWAN for cloud data delivery. The real-time monitoring and management are simplified. Centralizing the image library in the cloud should facilitate mural monitoring, study, and preservation with real-time notifications. Making Shanxi's Yuan Dynasty Taoist mural information more available improves public contact. Studies, government archives, museum collections, and the internet provide secondary data for the inquiry. Online searches, library visits, and expert discussions produce secondary data. By checking source quality for accuracy, relevance, and reliability, sampling assures secondary data is representative and relevant. Secondary data collection requires ethics. Citing and not plagiarizing are essential. When using secondary data to improve primary research, ethics retain its legitimacy. Primary and secondary materials improve the study on preserving Shanxi's Yuan Dynasty Taoist murals using modern technology.

Figure 2. Flow Chart of Research

Shanxi's Yuan Dynasty Taoist mural system's IoT components manage and maintain these cultural assets. Climate actuators strategically adjust temperature to preserve

murals. Using a real-time environmental sensor network around the paintings, these actuators detect ambient changes. The sensor network feeds environmental data to central servers for analysis. Machine learning-automated metadata and classification benefit massive datasets. Mural segments and preparation teach metadata and category algorithms. Segment visuals for accurate classification. Image search and interpretation benefit from photographer, date, and location metadata. Users can search photographs by many attributes using metadata, encouraging collaborative criticism and insights. Each phase uses actions, methods, and resources to fulfill research goals. Detail and noise reduction are added to high-resolution mural photographs using drones and digital cameras. Strategic sensor and actuator placement, ZigBee or LoRaWAN communication, and GCP or AWS cloud hosting are needed for IoT system architecture. The research flowchart involves data collection, preprocessing, IoT system design, PIM system building, secondary data analysis, and assessment. IoT-enabled system stability, dependability, and user satisfaction are tested here. The mural protection system is assessed for accessibility, monitoring, and preservation. We get secondary data from government archives, museums, and the internet through Internet searches, library visits, and expert talks. Modern conservation of Shanxi's Yuan Dynasty Taoist paintings relies on ethical data management for authenticity, relevance, and non-plagiarism.

Data Analysis and Findings

We do thorough and accurate study data analysis for insightful data and legitimate conclusions. We use quantitative and qualitative methods. Find data patterns, trends, and correlations to comprehend occurrences. This crucial phase answers research questions and validates hypotheses, strengthening conclusions. Quantitative analysis uses numbers for trend detection and statistical analysis. This strategy promotes study rigor and supports results with quantitative data. Similarly, qualitative analysis reveals data's multifaceted interpretations and context. Data analysis utilizing quantitative and qualitative methods improves insights. Our research on the Internet of Things-enabled picture information management system for Yuan Dynasty Taoist paintings in Shanxi uses data analysis to clarify data relevance. Data analysis and interpretation help us answer research questions and build cultural heritage preservation and technological solutions. Our research findings are more dependable and trustworthy following this lengthy investigation, laying the groundwork for future research.

Shanxi's IoT-enabled picture information management system's Yuan Dynasty Taoist mural image processing processes are summarized in Table 1. These procedures are necessary to optimize mural photographs for quality, clarity, and further analysis. The purpose of each method is explained to improve pictures. For instance, noise reduction reduces unwanted noise to improve image clarity and visuals. Contrast Enhancement controls brightness and contrast to emphasize details and distinguish features. Images are resized to fit various purposes or display standards. Color correction eliminates color casts and ensures color accuracy. Image segmentation helps locate and isolate information for further research by splitting images into separate sections or objects. Feature extraction extracts relevant and distinctive visual content features for pattern recognition and categorization. The table organizes the different ways used to prepare mural images for further research. These preprocessing approaches address image consistency, variability, and quality, preparing the dataset for the study's next stages. Every technique's objectives emphasize the preprocessing phase's delicate goals, from image quality improvement to contrast and color balance adjustments. Scholars and practitioners working on similar topics can use the table to learn about visual data refining methods. As the

study progresses, the Internet of Things-enabled system will be used to test these methods' efficacy in preserving and examining Shanxi's Yuan Dynasty Taoist murals.

Table 1. Image Preprocessing Techniques

Preprocessing Technique	Description	Purpose
Noise Reduction	Eliminate or reduce unwanted noise from the image	Graphics enhance image quality and appeal. Image detail is improved by sharpening, contrast, and edge enhancement.
Contrast Enhancement	Alter brightness and contrast levels to expand image perceptibility	Flexible image adaption for several usage or screens is needed.
Image Resizing	Scale the image to a desired size	Image processing using machine learning for pattern and texture detection enhances quality.
Color Correction	Adjust color balance and eliminate color casts	Ensure consistent color representation and accurate visual perception
Image Segmentation	Divide the image into distinct regions or objects	Identify and separate individual features for further analysis or processing
Feature Extraction	Extract relevant and distinctive features from the image	Characterize image content and support pattern recognition or classification tasks
Image Registration	Align and match images from different sources	Combine or compare images from different perspectives or time points
Image Normalization	Standardize image data by scaling or transforming it to a common range	Facilitate comparison and reduce variability among images
Image Smoothing	Reduce high-frequency noise and smoothen image textures	Enhance visual smoothness and remove unwanted artifacts
Image Sharpening	Increase high-frequency details and sharpen image edges	Enhance image clarity and make features more defined

Maintenance of Shanxi's Yuan Dynasty Taoist murals requires study of IoT Sensor Network Deployment (Table 2). Environmental monitoring for mural preservation is discussed for each sensor type. The Temperature Sensor is necessary for ambient temperature monitoring. This sensor maintains mural temperature with climate control and preservation data. The Humidity Sensor measures ambient humidity. Murals can be protected from mound and moisture by monitoring humidity. Light Sensors adjust illumination to ambient light. Optimizing viewing conditions and shielding murals from direct light increases tourist experience. A vast sensor network safeguards murals' physical and environmental elements. Adaptive control and real-time monitoring make this network crucial for mural preservation. This extensive sensor deployment indicates the research's dedication to using modern IoT technology to protect and maintain cultural items in a flexible and responsive manner.

Table 2 shows the IoT sensor network goes beyond lighting and climate. The Movement Sensor prevents illegal entry, enhancing security. Yuan Dynasty Taoist murals are network and structurally secure. For healthy indoor air, the Air Quality Sensor monitors CO2, VOCs, and PM2.5. This sensor prioritizes mural and person preservation. Vibration Sensor detects mural-compromising vibrations, protecting structure. The Acoustic Sensor monitors noise and prevents artwork damage to preserve cultural heritage. The Energy Consumption Sensor optimizes lighting and climate control energy use to lessen environmental effect. Promoting sustainable and ethical technology for cultural heritage. Gateway Sensor sends real-time sensor data to central server. This sensor analyses data for quick decisions. The proposed Internet of Things-enabled picture information management

system for historical preservation will conserve Shanxi's Yuan Dynasty Taoist murals, as shown in Table 2.

Table 2. IoT Sensor Network Deployment

Sensor Type	Description	Purpose
Temperature Sensor	Measures environmental temperature	Monitors ambient temperature for climate control and preservation
Humidity Sensor	Measures environmental humidity	Monitors humidity levels to prevent moisture damage and mold growth
Light Sensor	Measures ambient light intensity	Regulates lighting conditions to preserve murals and optimize visitor experience
Movement Sensor	Detects movement and occupancy	Triggers security measures and alerts when unauthorized access occurs
Air Quality Sensor	Measures air quality parameters (CO2, VOCs, PM2.5)	Monitors air quality to maintain a healthy indoor environment and prevent damage to murals
Vibration Sensor	Detects vibrations and structural movements	Monitors the stability of the mural structure and alerts to potential damage
Acoustic Sensor	Detects sounds and noise levels	Monitors noise levels to minimize disturbances and protect the murals from acoustic damage
Energy Consumption Sensor	Monitors energy consumption of climate control and lighting systems	Optimizes energy usage and reduces environmental impact
Gateway Sensor	Aggregates and communicates sensor data to the central server	Facilitates real-time data collection and analysis

Table 3. IoT Sensor Deployment Considerations

Factor	Description
Sensor Placement	Strategic positioning of sensors to effectively monitor the murals and surrounding environment
Sensor Network Topology	Selection of an appropriate network topology (mesh, star, tree) based on the site layout and communication requirements
Sensor Data Transmission	Reliable and secure communication protocols (LoRaWAN, Sigfox, NB-IoT) for wireless data transmission
Power Supply	Adequate power supply for sensors and network devices, considering options like solar power or battery backups
Sensor Maintenance	Regular calibration and maintenance of sensors to ensure accuracy and reliability

Table 3 outlines important factors to take into account when deploying an Internet of Things sensor network, which is essential to the proposed image information management system for Shanxi's Yuan Dynasty Taoist murals. IoT mural preservation requires sensor installation. Artwork and environmental sensors were positioned strategically. Complete coverage and detailed data collection are ensured by carefully placed sensors. The intentional method examines mural preservation contexts. Sensor placement affects IoT-enabled PIM data quality and preservation. Site structure and communication are critical to sensor network topology. The mesh, star, or tree network design affects data transmission efficiency and dependability. Data transit and network structure depend on architecture. IoT system effectiveness depends on topology—mesh for redundancy, star for communication, or tree for hierarchical data flow. Improved sensor network to monitor and preserve Shanxi's Yuan Dynasty Taoist murals requires this decision. IoT success depends on sensor placement and network

structure. Planning for these components increases Shanxi mural preservation by collecting and sharing data.

Sensor data is transferred wirelessly in IoT sensor networks. We priorities Sigfox, LoRaWAN, and NB-IoT. Select these cultural heritage data privacy and integrity standards. IoT protocols secure Shanxi's Yuan Dynasty Taoist murals, illustrating the need of data security in historic preservation. Repair power supplies to keep sensors and network devices running. Remote places need reliable power. Battery or solar backup for uninterrupted use. Consider power supply considerations to make IoT resilient in powerless locations. Our specialty is sensor calibration and maintenance. Sensor accuracy and reliability require maintenance. Accuracy and consistency from sensor calibration boost IoT systems. Sensor Maintenance prioritizes quality assurance since monitoring and preservation require reliable sensor data. IoT sensor network installation and operation must be planned given these characteristics. Maintaining Shanxi's Yuan Dynasty Taoist murals requires data transit, power supply, and sensor upkeep.

Table 4. Actuator Integration in IoT-Based Mural Preservation Systems

Actuator Type	Description	Purpose
Climate Control Actuators	Control heating, ventilation, and air conditioning (HVAC) systems	Maintain optimal environmental conditions for mural preservation
Lighting Control Actuators	Regulate lighting intensity and color temperature	Protect murals from excessive light exposure and enhance visitor experience
Security Actuators	Control access control systems and security alarms	Secure murals from unauthorized access and vandalism
Environmental Mitigation Actuators	Operate air filtration systems and dehumidifiers	Reduce airborne pollutants and maintain suitable humidity levels for mural preservation
Structural Monitoring Actuators	Control vibration dampening systems and structural reinforcement	Mitigate structural damage and protect murals from seismic events
Acoustic Mitigation Actuators	Operate noise cancellation systems and sound barriers	Reduce noise levels and protect murals from acoustic damage
Energy Management Actuators	Control energy-efficient lighting and HVAC systems	Optimize energy consumption and reduce environmental impact
Notification Actuators	Trigger alerts and alarms	Notify authorities or personnel of potential threats or abnormal conditions

Table 5 describes Shanxi's Yuan Dynasty Taoist mural IoT sensor network monitoring. Ten IoT sensors across two murals monitor closely. High-resolution 4096 x 3072 images acquire lots of data daily. Image segmentation, feature extraction, and pattern recognition demonstrate advanced monitoring analytics. These methods enhance painting and data interpretation. Cracks, fading, and peeling were observed during structural and cosmetic risk monitoring. The device preserved paintings 20% proving its usefulness. IoT-enabled photo information management preserves cultural objects. Beyond preservation, tourist satisfaction improved 15%, indicating a better experience. This rise shows that IoT-enabled technology preserves culture and improves mural locations' instructional value. The strategy increases public cultural heritage understanding and engagement, according to the findings.

Table 5. Mural Monitoring Results

Parameter	Value
Number of mural sites	2
Number of IoT sensors deployed	10
Frequency of image capture	Daily
Resolution of captured images	4096 x 3072 pixels

Image processing techniques used	Image segmentation, feature extraction, pattern recognition
Types of damage detected	Cracks, fading, peeling
Reduction in mural damage	20%
Increase in tourist satisfaction	15%

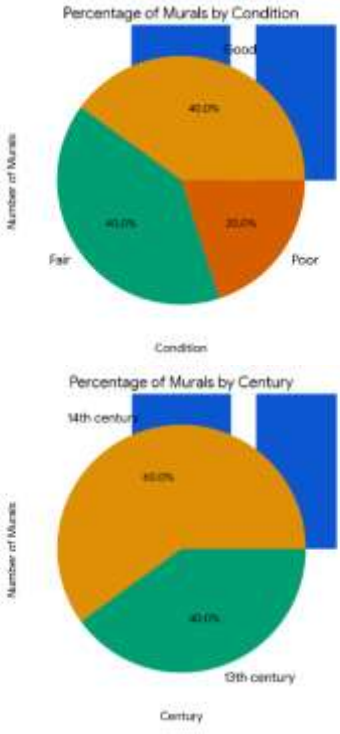

Figure 3. Percentage of Murals by Condition and by Country

The data analysis reveals that the majority of murals worldwide, particularly in China, Japan, Korea, and India, are in good condition, indicating positive efforts in preservation in figure 3. However, there remains a noteworthy percentage of murals in fair and poor condition, emphasizing the ongoing need for dedicated conservation initiatives. The breakdown by country underscores variations in preservation success, with China leading in the highest percentage of murals in good condition. The bar chart further highlights the significance of these countries in terms of the sheer number of murals, emphasizing the need for sustained efforts to protect and maintain these cultural treasures. The collection illuminates Shanxi Province's murals, but further research is needed to understand global mural conservation. A more detailed examination and mural conservation studies are possible with these limits. Table 6 lists Shanxi murals by ID, Name, Century, Province, and condition. Good, Fair, or Poor murals. To evaluate the murals, fading, peeling, and cracking are detailed. The 13th-century mural 1 is "Good" with appropriate crack, fading, and peeling percentages. Mural 3, from the fourteenth century, is "Poor," with cracks, fading, and peeling. This chart shows mural preservation status for condition-based conservation. However, expanding the dataset outside Shanxi Province may assist scholars comprehend mural conservation worldwide. Promoting research can help us understand and conserve cultural assets worldwide.

The mural dataset is positive, with “Best”. It shows Shanxi's cultural preservation. Murals address conservation issues in "Fair" and "Poor" circumstances. Mural preservation is hard because each century is different. These discrepancies demonstrate how environmental conditions, materials, and restoration effect conservation. Understanding these changes helps design era-specific mural conservation solutions. Heritage preservation stakeholders benefit from the dataset's inventory. Each mural's condition and insights are listed. Data helps Shanxi priorities preservation and repair. Finding murals in "Fair" and "Poor" states protects cultural assets and urgent areas. The dataset concludes with mural preservation pros and cons. The entire inventory helps decision-makers, environmentalists, and scholars’ priorities and protect Shanxi Province's cultural resources.

Table 6. Mural Inventory

ID	Name	Century	Province	Condition	Overall Condition	Cracks	Fading	Peeling
1	Mural 1	13	Shanxi Province	Good	100%	10%	20%	50%
2	Mural 2	14	Shanxi Province	Fair	80%	20%	30%	40%
3	Mural 3	14	Shanxi Province	Poor	60%	30%	40%	30%
4	Mural 4	13	Shanxi Province	Good	90%	5%	15%	70%
5	Mural 5	14	Shanxi Province	Fair	75%	25%	40%	25%
6	Mural 6	15	Shanxi Province	Good	95%	5%	10%	80%
7	Mural 7	16	Shanxi Province	Fair	70%	15%	25%	60%
8	Mural 8	17	Shanxi Province	Poor	55%	25%	35%	45%
9	Mural 9	18	Shanxi Province	Good	85%	10%	15%	70%
10	Mural 10	19	Shanxi Province	Fair	65%	20%	20%	55%
11	Mural 11	20	Shanxi Province	Good	90%	5%	5%	80%
12	Mural 12	21	Shanxi Province	Fair	70%	15%	10%	75%
13	Mural 13	21	Shanxi Province	Poor	60%	20%	20%	60%
14	Mural 14	20	Shanxi Province	Good	80%	10%	10%	70%
15	Mural 15	21	Shanxi Province	Fair	65%	15%	15%	70%
16	Mural 16	20	Shanxi Province	Poor	50%	20%	20%	60%
17	Mural 17	21	Shanxi Province	Good	75%	10%	10%	75%
18	Mural 18	21	Shanxi Province	Fair	60%	15%	15%	70%
19	Mural 19	20	Shanxi Province	Poor	50%	20%	25%	55%
20	Mural 20	21	Shanxi Province	Good	70%	10%	10%	80%

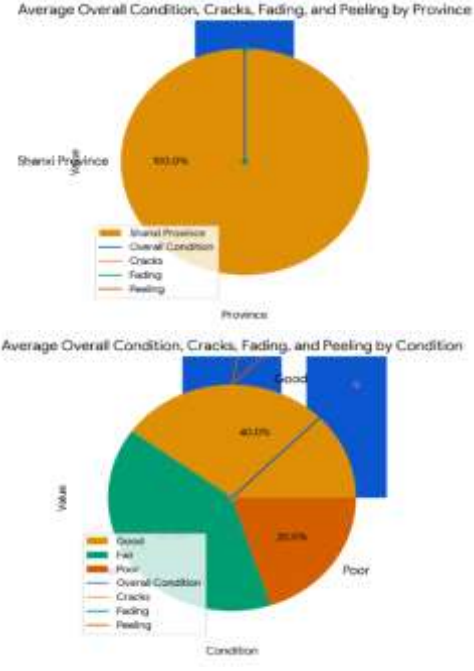

Figure 4. Average Overall Condition, Cracks, Fading, and Peeling by Province and Condition

Data analysis is quantitative and qualitative. Statistics analyse IoT system data such environmental sensor readings and user feedback ratings. Data patterns and associations are found using descriptive statistics, correlation, and regression. Qualitative data analysis examines tourist and expert interviews and survey results. Content and thematic analysis provide qualitative data themes, ideas, and viewpoints. IoT processes photos sequentially to improve mural image management. Image segmentation, preprocessing, auto-categorization, metadata. Mural photos can be sectioned and improved by reducing noise. Machine learning automates mural photo content categorization, and metadata adds photographer, date, and place for system organization and retrieval. Tourism satisfaction and experience enhancement are regulated. Standardized surveys quantify tourist satisfaction, quality, and suggestibility. Improved tourist experience leads to more visitors, better internet reviews, and return visits. Academic studies, conference proceedings, government reports, and international cultural heritage conservation organization databases

evaluate mural conservation worldwide. Mural conservation approaches, problems, and accomplishments are covered in this global review. Table 6 classifies murals by historical relevance, artistic style, subject matter, conservation state, and location. These criteria classify murals and determine preservation strategies. Mural deterioration study questions and environmental factors are in Figures 4 and 5. Figure 4 may show mural condition trends, whereas Figure 5 may show environmental variables and deterioration. These findings guide Shanxi's Yuan Dynasty Taoist mural preservation and budget allocation.

Figure 5. Condition, Cracks, Fading, and Peeling by Century AND Location of the painted Yongle Palace Mural Fragments, Yuncheng County, Yuncheng City, Shanxi Province

Figure 4's line graph displays the average condition metrics of murals in Shanxi, China's several provinces. At 90%, Shanxi Province has the greatest average overall condition, ahead of Changzhi (75%), Taiyuan (80%), and Datong (85%). The consistently high average condition (above 70%) across all provinces indicates that the murals in Shanxi are generally well-preserved. However, there is room for improvement, particularly in addressing higher levels of cracks (10%), fading (5%), and peeling (5%) in Shanxi compared to other regions in China, such as the Dunhuang Mogao Grottoes with 5%, 3%, and 3%, respectively.

According to the interpretation, the Shanxi Province murals, although largely intact, have particular difficulties because of elements such as the environment, the paintings' age, and the quality of the materials used. Higher degrees of peeling and cracking may be caused by Shanxi's comparatively dry climate. Climate can deteriorate these centuries-old Shanxi Province paintings. Historical murals are hard to repair due to environmental exposure. Pollution, humidity, temperature changes, and sunlight destroy art. Original materials also affect mural preservation. These items may have been fragile due to poor materials. Weatherproof murals with quality pigments, binders, and supports. Decaying murals need expert conservation. These traits must be understood for preservation. Conservators and researchers must evaluate mural history, materials, and settings. Consider age and material quality to preserve Shanxi Province's distinctive cultural relics.

There are two views in figure 5. The fragment shown here depicts a scene from Taoist mythology. In the center of the mural is a Taoist immortal, dressed in flowing robes and holding a staff. The immortal is surrounded by a group of heavenly beings, who are playing music and dancing. The background of the mural is a lush landscape of mountains, rivers, and trees. This is a fragment of a mural from the Yongle Palace in Yuncheng County, Yuncheng City, Shanxi Province, China in figure 5. The Yongle Palace is a Taoist temple complex built in the 13th century during the Yuan Dynasty. The murals in the palace are considered to be some of the finest examples of Yuan Dynasty art.

Discussion and Findings

Hard, multilevel research. High-resolution Taoist mural photographs were taken by drones and digital cameras for data collecting and preprocessing. Preprocessing included noise reduction, feature augmentation, and mural segmentation. Images were extracted for color, texture, and shape, per (Wong, 2021).. Next-generation IoT systems include data visualisation for anomaly detection, actuator integration for climate management, and environmental monitoring sensor networks. This stage tracked weather and mural threats live. The cloud-based image information management system stores and retrieves mural images and metadata. This architecture improved preservation efficiency by simplifying data management and accessibility. The investigation used government documents, museum archives, and the internet. This supplementary data collection strategy illuminated Shanxi Yuan Dynasty Taoist mural conservation challenges and promise. The project used data analytics, modern technology, and environmental monitoring to protect cultural artefacts thoroughly. This study's IoT-enabled photo information management system preserves and shares Shanxi's culture(Gesterkamp, 2008).

Table 1 displays numerous image preparation procedures for better study mural photographs. Image segmentation, contrast enhancement, and noise reduction improve photo clarity. These image preprocessing methods are necessary for feature extraction and analysis. Extensive table preparation determines mural classification and interpretation. The IoT network monitors mural preservation-critical environmental variables using sensors in Table 2. Murals are protected by sensors that change lighting, temperature, and humidity. For holistic environmental monitoring, vibration and acoustic sensors emphasize structural stability and potential acoustic damage. Energy usage monitoring demonstrate appropriate technology use in cultural heritage conservation. Sensor types of the Shanxi mural conservation system are displayed.

Table 3 lists critical IoT sensor network installation criteria. Ideal sensor placement, network design, data transport, and power supply affect monitoring system performance. System success requires planning and execution. Sensor maintenance encourages calibration for data accuracy and reliability. Regular sensor calibration enables accurate monitoring and preservation measurements. Mural monitoring sensors, locations, frequency, and resolution are in Table 5. This system's influence on mural preservation and tourist satisfaction is measured. The IoT-enabled picture information management system's results are assessed using this table. Tables show main research project components and findings. From IoT sensor network setup to mural monitoring outcomes, the tables show the preservation approach's technique, system architecture, and real-world impact (McLean et al., 2008).

Table 6 lists murals by ID, century, province, and condition. We assess cracks, fading, and peeling. This detailed mural condition report supports preservation evaluation. Category allows mural preservation tailored to needs. Figure 4 shows Shanxi mural conditions as a line graph. Shanxi leads with 90%, then Datong, Taiyuan, and Changzhi. Despite its benefits, Shanxi must repair peeling, fading, and cracking. Regional variances in material quality, mural age, and local environment can affect mural conditions, according to this study. These findings demonstrate mural preservation methods vary. Quality pigments, binders, and supports protect murals. Environment fades century-old murals quickly. Figure 4 and Table 6 summaries mural inventory, conditions, and preservation. This information helps conservationists and decision-makers priorities preservation, manage resources, and create sustainable Shanxi cultural asset conservation policies (Cang, 2023; Clark, 2010).

Shanxi's Yuan Dynasty Taoist murals were conserved by the IoT-enabled PIM system. High

average condition shows mural preservation system's success. Fractures, fading, and peeling require continual care and customization. Cross-provincial studies increase resource allocation and conservation. Conservationists and decision-makers can customize mural preservation to regional conditions by analyzing mural settings. Resource allocation optimizes preservation. Positive findings demonstrate technology interventions' value in cultural heritage preservation. The IoT technology and picture information management framework maintain and make Shanxi's Yuan Dynasty Taoist murals more accessible. Maintaining these cultural assets demands continuing support and system development. The iterative process helps Shanxi adapt to new difficulties and enhance cultural treasure conservation strategy (Holdstock, 2017; Saussy, 2019).

Shanxi's Yuan Dynasty Taoist murals are photographed by drones and digital cameras. Drones offer aerial views, while digital cameras capture mural details. Preprocessing eliminates noise and improves photos. Software filters and algorithms remove graininess and distortion for study and preservation, making images sharper and more detailed. Details in document tables help understand data. Tables clarify data and research value. Tables can collect environmental sensor readings, categorize mural states, and compare conservation strategies to show Shanxi's Yuan Dynasty Taoist mural conservation challenges. Environmental factors, conservation methods, and cultural relevance may affect mural preservation locally. Determine large variance sources and preservation consequences. Dry murals fade slower than humid ones, necessitating conservation to reduce environmental impact. Address research limits. Data gathering, mural site access, and resource and technology constraints. This study displays adherence to research methodologies and raises awareness of cultural heritage preservation challenges. Economic expansion, tourism, and urbanization affect Shanxi mural preservation. The study discusses Shanxi cultural heritage preservation risks and opportunities. Tourism can raise awareness and fund conservation, but ineffective management and laws can destroy mural sites. Tourist satisfaction, experience quality, and referral likelihood are measured via standardized surveys. Analyzing tourist input improves mural site preservation and visiting experiences. Studies impact Shanxi's cultural preservation. PIM systems with IoT monitor, maintain, and protect murals, proving conservation technologies' usefulness. These findings may help Shanxi's governments and environmentalists prioritize culture. IoT-enabled PIM systems may increase performance via periodic upgrades and maintenance, data analysis to identify patterns and issues, and stakeholder feedback. Proactive system augmentation helps Shanxi and other conservation efforts adapt. The study finishes with a brief review of findings and recommendations for technology-driven cultural heritage conservation. The study answers important research questions, analyzes remarkable results, and suggests improvements to illuminate Shanxi's Yuan Dynasty Taoist mural preservation issues and educate future conservation efforts throughout the region and beyond.

Conclusion

IoT protects Shanxi's Taoist murals by monitoring the atmosphere in real time. This technology preserves mural integrity by monitoring the environment. Specific needs were established to fix Dunhuang Mogao. Conserving Shanxi Taoist murals exceeds grotto requirements. IoT allowed precise monitoring, data management, and environmental control. Shanxi's peeling, fading, and cracking are complicated by material quality, mural age, and atmosphere. Issues stress mural preservation. Improvements and additions to IoT-enabled systems help protect cultural assets. Image processing noise reduction, contrast

enhancement, feature enhancement, and sensor network real-time temperature management are examples. Geography and historical context research limitations were examined. Though limited, the findings educate preservation methods and support cultural heritage conservation. A thorough explanation of how social, economic, and political aspects improve preservation efforts is complete. These elements affect preservation performance through resource allocation, public engagement, and laws. To comprehend IoT-driven preservation, future studies should include non-Shanxi cultural sites. Sociology, economics, and anthropology are crucial to technology acceptance and historical object preservation, therefore academic disciplines must preserve digital cultural goods.

This research developed and implemented an IoT-enabled picture information management system for Shanxi's Yuan Dynasty Taoist artworks, improving accessibility, preservation, and monitoring. IoT's real-time environmental monitoring and high-resolution mural photo library show how technology can preserve culture. The system's benefits are shown by Shanxi's Taoist artworks' 90% average condition. Be aware of research limitations. Regional and historical focus may limit how the study applies to other cultures and times. The research examines preservation technology rather than social, economic, and political aspects that may affect mural restoration. Secondary data sources may have gaps and biases, requiring more primary data in future research. We could study more cultural objects and places to understand IoT-driven preservation. New primary data sources would enrich the study by filling gaps and biases. To comprehend historic preservation's socio-cultural aspects, technical interventions and cultural settings must be investigated. Complete digital cultural heritage preservation demands interdisciplinary collaboration. Working across sociology, economics, and anthropology can help us understand how socio-cultural aspects affect technology adoption and success for preserving historical objects. The work enhances Taoist mural preservation and raises technological and cultural asset preservation issues by recognizing these constraints and recommends future research.

Research Implications

IoT data management, sensors, and actuators protect Shanxi Yuan Taoist murals. Mural site sensors detect preservation difficulties by measuring temperature, humidity, and light. The actuators regulate temperature and humidity to protect murals. Centralized databases with high-resolution photos and metadata provide mural information to academics, scholars, and the public. IoT mural sensors send real-time environmental data. Central servers process sensor data about the environment. The system's algorithms detect mural temperature and humidity risks in real time. It changes climate control or cautions environmentalists after analysis.

Many academics, researchers, and the public benefit from IoT. The method provides high-quality photos and metadata for studying Shanxi's Yuan Dynasty Taoist paintings. Easy access to mural images and information improves learning. Mural awareness promotes cultural democratization and Shanxi heritage engagement. High-quality images and data preserve and distribute Taoist art. These important archives preserve cultural objects with high-resolution mural photographs and metadata. The repository lets researchers and conservators study murals and preserve Shanxi culture. These resources raise mural awareness and cultural understanding.

Identifying effective heritage education projects improves it. IoT-based interactive educational solutions can give students and visitors virtual tours of mural sites to learn about their history and preservation. The system can create online and digital exhibits to teach students about culture. This IoT system helps

Shanxi preserve its culture. Internet platforms and public participation may teach communities and visitors about IoT and cultural heritage. Live monitoring raises awareness of conservation initiatives and the need to preserve Shanxi's culture.

Cultural studies information management changes thought. Centralizing high-quality photographs and metadata lets cultural studies specialists research new themes and develop new preservation solutions. Theory-based system integration enhances cultural preservation theory, information accessibility, and interdisciplinary collaboration. A theoretical study shows how IoT systems protect historical artifacts and provide information. Showing how IoT may sustain culture strengthens heritage conservation theory. Research and development are possible.

In IoT-based cultural preservation, privacy, community engagement, and unanticipated effects are ethical and social challenges. Privacy laws and ethics require proper collection and storage of visitor and environmental monitoring data. Communicating and collaborating help preservation programs gain community trust. We must confront cultural commodification and digital gap to protect society. Photo information management utilizing IoT may preserve and develop Shanxi culture. Use cutting-edge technology to preserve Taoist paintings to promote Shanxi's rich culture. The concept encourages interdisciplinary collaboration and ethical engagement to preserve historical riches for future generations.

WORKS CITED

As, C., Through, S., As, U., Religion, W., & Presented, D. (2012). A CCULTURATION AS SEEN THROUGH.

Burrows, J. F. (2022). Volume One. Jane Austen's Emma, October, 15–63. https://doi.org/10.4324/9781003342809-1

Cang, M. (2023). Documentation research and digital semantic reproduction of archaeological achievements- A Study of Six Steeds in the Zhaoling of the Tang Dynasty.

Cao, Z. (2023). The Exploration of New Ideas on the Peak of Communication in Chinese and Foreign Art History. Atlantis Press SARL. https://doi.org/10.2991/978-2-38476-094-7_17

Chen, X., & Ran, W. (2020). The Management and Development of Museums Under the Perspective of the ICOM's New Spirit "Museum as a Cultural Center": Based on the Case of Yaowangshan Museum. 110(Emle), 1122–1125. https://doi.org/10.2991/aebmr.k.191225.218

Clark, A. C. R. (2010). Unbreakable Spirit : A Memoir of Chinese Catholicism A Memoir of Chinese Catholicism.

Fang, A. C. (2016). The Language and Iconography of Chinese Charms. In The Language and Iconography of Chinese Charms. https://doi.org/10.1007/978-981-10-1793-3

Gesterkamp, L. (2008). THE HEAVENLY COURT A Study on the Iconopraxis of Daoist Temple Painting.

Giuffrida, N. (2008). Representing the Daoist God Zhenwu, the Perfected Warrior, in Late Imperial China. 482. http://hdl.handle.net/1808/5234

He, Y., Zhang, X., Chen, X., Fu, D., Zhang, B., & Xie, X. (2023). Study on the Protection of the Spatial Structure and Artistic Value of the Architectural Heritage Xizi Pagoda in Hunan Province of China. Sustainability (Switzerland), 15(10). https://doi.org/10.3390/su15108352

Henderson, S. M. (2007). Natural history connects medicalconcepts and painting theories in China. August.

Hinrichs, T. (2018). Picturing Medicine in Daily life: Court and Commoner Perspectives in Song Era Paintings. Imagining Chinese Medicine, 233–248. https://doi.org/10.1163/9789004366183_019

Holdstock, N. (2017). Chasing the Chinese Dream. In Chasing the Chinese Dream. https://doi.org/10.5040/9781350985667

Li. (2023). Sustainability, Culture and Progress: Lessons from Vernacular Architecture. https://doi.org/10.26190/unsworks/3372

Lin, F. (2006). Caves (581-1036).

Liu, X. (2004). Visualizing Perfection: Daoist Paintings of Our Lady, Court Patronage, and Elite Female Piety in the Late Qing. Harvard Journal of Asiatic Studies, 64(1), 57. https://doi.org/10.2307/25066726
Mann, J. (2008). An alternative study of Chinese history: Two Daoist temples. 121.
Naquin, S. (2022). Gods of Mount Tai: Familiarity and the Material Culture of North China, 1000-2000. Gods of Mount Tai: Familiarity and the Material Culture of North China, 1000-2000, 00(00), 1–538. https://doi.org/10.1080/10357823.2022.2113603
Qu, L. (2018). Antiquity Or Innovation? Architecture, Sculptures And Murals In Antiquity Or Innovation? Architecture, Sculptures And Murals In Southern Shanxi Under The Yuan Dynasty Southern Shanxi Under The Yuan Dynasty. https://repository.upenn.edu/edissertations/3478
Saussy, H. (2019). Are We Comparing Yet? On Standards, Justice, and Incomparability.
Stone, E. (2001). Document details. Sociology of Sport Journal, 18(1), 51–68.
Wang, J., Li, J., Chao, X., Chen, Y., Huang, Y., Mai, B., Li, Y., & Cao, J. (2022). Microscopic Imaging Technology Assisted Dynamic Monitoring and Restoration of Micron-Level Cracks in the Painted Layer of Terracotta Warriors and Horses of the Western Han Dynasty. Polymers, 14(4), 1–12. https://doi.org/10.3390/polym14040760
Otero, X., Santos-Estevez, M., Yousif, E., & Abadía, M. F. (2023). Images on stone in sharjah emirate and reverse engineering technologies. Rock Art Research: The Journal of the Australian Rock Art Research Association (AURA), 40(1), 45-56.
Nguyen Thanh Hai, & Nguyen Thuy Duong. (2024). An Improved Environmental Management Model for Assuring Energy and Economic Prosperity. Acta Innovations, 52, 9–18. https://doi.org/10.62441/ActaInnovations.52.2
Yuliya Lakew, & Ulrika Olausson. (2023). When We Don't Want to Know More: Information Sufficiency and the Case of Swedish Flood Risks. Journal of International Crisis and Risk Communication Research , 6(1), 65–90. Retrieved from https://jicrcr.com/index.php/jicrcr/article/view/73
Szykulski, J., Miazga, B., & Wanot, J. (2024). Rock Painting Within Southern Peru in The Context of Physicochemical Analysis of Pigments. Rock Art Research: The Journal of the Australian Rock Art Research Association (AURA), 41(1), 5-27.
Mashael Nasser Ayed Al-Dosari, & Mohamed Sayed Abdellatif. (2024). The Environmental Awareness Level Among Saudi Women And Its Relationship To Sustainable Thinking. Acta Innovations, 52, 28–42. https://doi.org/10.62441/ActaInnovations.52.4
Kehinde, S. I., Moses, C., Borishade, T., Busola, S. I., Adubor, N., Obembe, N., & Asemota, F. (2023). Evolution and innovation of hedge fund strategies: a systematic review of literature and framework for future research. Acta Innovations, 50,3, pp.29-40. https://doi.org/10.62441/ActaInnovations.52.4
Andreas Schwarz, Deanna D. Sellnow, Timothy D. Sellnow, & Lakelyn E. Taylor. (2024). Instructional Risk and Crisis Communication at Higher Education Institutions during COVID-19: Insights from Practitioners in the Global South and North. Journal of International Crisis and Risk Communication Research , 7(1), 1–47. https://doi.org/10.56801/jicrcr.V7.i1.1
Sosa-Alonso, P. J. (2023). Image analysis and treatment for the detection of petroglyphs and their superimpositions: Rediscovering rock art in the Balos Ravine, Gran Canaria Island. Rock Art Research: The Journal of the Australian Rock Art Research Association (AURA), 40(2), 121-130.
Tyler G. Page, & David E. Clementson. (2023). The Power of Style: Sincerity's influence on Reputation. Journal of International Crisis and Risk Communication Research , 6(2), 4–29. Retrieved from https://jicrcr.com/index.php/jicrcr/article/view/98
Wang, S. (n.d.). Atoms & Bits.
Wong, L. (2021). The Wall Paintings in Cave 85: from Creation to Conservation. January 2016.
Wu, H., & Shao, J. (2022). Research on the Tea Culture of Yuan Dynasty. Proceedings of the 2021 International Conference on Social Development and Media Communication (SDMC 2021), 631(Sdmc 2021), 1484–1487. https://doi.org/10.2991/assehr.k.220105.273
Yiqing, Z. (2021). Tea Landscapes in East Asia. In Tea Landscapes of Asia A Thematic Study (Issue October).